

Sentinel-1



What is Sentinel-1?

Sentinel-1A was launched on 3 April 2014 and Sentinel-1B on 25 April 2016, both on a Soyuz rocket from Europe's Spaceport in French Guiana for land and sea monitoring, natural disasters mapping, sea ice observations and ship detection. It is an outstanding example of Europe's technological excellence. Sentinel-1 is a radar imaging satellite which delivers images day and night under all weather conditions.

Sentinel-1A is the first satellite in a new fleet of EU-owned Earth observation satellites called the Sentinels and is the successful result of close collaboration between the European Commission, the European Space Agency, industry, service providers and data users. Designed and built by a consortium of around 60 companies led by Thales Alenia Space and Airbus Defence and Space, Sentinel-1 focuses on reliability, operational stability, global coverage and quick data delivery. It is expected to enable the development of new applications and meet the evolving needs of Europe's Copernicus programme. This global Earth observation and monitoring programme makes a change in the way we manage our environment, understand and tackle the effects of climate change, and safeguard everyday lives by offering data (images) and a set of key information services for a broad range of applications, including disaster management.

The mission benefits numerous services. For example, services that relate to the monitoring of Arctic sea-ice extent, routine sea-ice mapping, surveillance of the marine environment, including oil-spill monitoring and ship detection for maritime security, monitoring land-surface for motion risks, mapping for forest, water and soil management and mapping to support humanitarian aid crises as well as natural and man-made emergency disasters.

Sentinel-1 mission

The Sentinel-1 mission is designed as a two polar-orbiting satellites constellation. The Sentinel-1 mission provides an independent operational capability for continuous radar mapping of the Earth and is designed to provide enhanced revisit frequency, coverage, timeliness and reliability for operational services and applications requiring long-time series.

The mission provides an operational interferometry capability through stringent requirements placed on attitude accuracy, attitude and orbit knowledge, and data-take timing accuracy.

The constellation covers the entire world's land masses on a bi-weekly basis, sea-ice zones, Europe's coastal zones and shipping routes on a daily basis and open ocean continuously by wave imageries.

The Sentinel-1 synthetic aperture radar instrument (SAR) instrument and short revisit time greatly advance users' capabilities and provide data routinely and systematically for maritime and land monitoring, emergency response, climate change and security.

Each Sentinel-1 satellite is expected to transmit Earth observation data for at least 7 years and each has fuel on-board for 12 years.

Concrete applications

Oceans and Ice

Essential information regarding the state and dynamics of oceans and coastal zones is delivered by the Copernicus marine services. These services not only help to protect and manage the marine environment and its resources, but also aim to keep vessels safe at sea. Radar images provided by Sentinel-1 generate timely maps of sea-ice conditions for safe passage in our increasingly busy Arctic waters. Thinner, more navigable first-year ice can be distinguished from the dangerous, much thicker multiyear ice to help assure safe year-round navigation in ice-covered Arctic and sub-Arctic zones. These radar images are particularly suited to generating high-resolution ice charts, monitoring icebergs and forecasting ice conditions. Sentinel-1 also delivers continuous sampling of the open ocean, providing information on wind and waves which is useful for understanding interactions between waves and currents and improving efficiency for shipping and wave-energy applications, potentially producing economic benefits. Additionally, these observations can be used to track the paths of oil slicks and other polluters.



Changing lands

The Sentinel-1 mission opens up new possibilities for many land applications. The satellites' frequent revisits over the same area allow close monitoring of changes in land cover, which is particularly useful for keeping an eye on tropical forests that are typically shrouded by cloud and for detecting illegal timber harvesting worldwide.

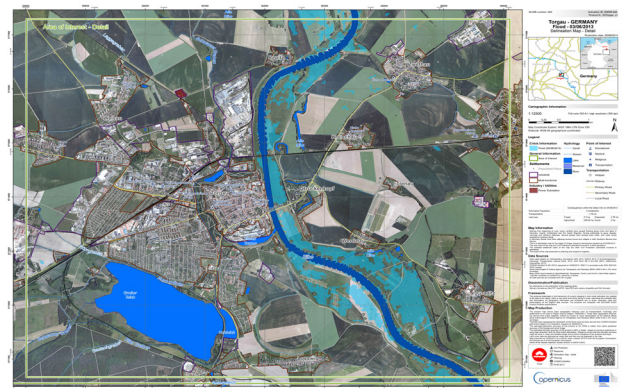
Land cover information is also important for agricultural practices by estimating crop acreage, providing soil moisture information and forecasting yields and makes Sentinel-1 a valuable complement to the upcoming Sentinel-2 multispectral optical mission. Additionally, this new mission is the only European satellite specifically designed for fast response to emergencies and disasters such as flooding and earthquakes.

Radar images – such as those provided by Sentinel-1's C-band SAR – are the best way of tracking land subsidence and structural damage. The 'radar interferometry' remote sensing technique combines two or more radar images over the same area to detect changes occurring between acquisitions.

Interferometry allows for the monitoring of even slight ground movement – down to a few millimetres – across wide areas. In addition, the radar ability of Sentinel-1 enables it to 'see' through clouds, rain, ashes and in darkness. As well as being a valuable resource for urban planners, this kind of information is essential for monitoring shifts from earthquakes, landslides and volcanic uplift.

Emergency response

The Copernicus Emergency Management Service aims to reinforce Europe's capacity to respond to emergency situations, be they caused by extreme weather, geophysical hazards such as earthquakes, or man-made disasters such as oil spills and humanitarian crises. Images with a resolution of 10 m can be provided by the C-band SAR on Sentinel-1 within hours of acquisition to aid emergency response. Such imagery can be used for precise terrain deformation monitoring over landslide, seismic or subsidence areas by providing regular and frequent interferometric observations. Impact assessment for many types of hazards including hydrometeorological and geological events can also be supported. Comparison of images acquired before and after a flood offers instant information on the extent of inundation and assists in the assessment of property and environmental damage. The mission also provides information on wind and waves, which can be used to track the paths of oil slicks and other pollutants.



Copernicus data and services are available on a full, open and free-of charge basis to users, including EU institutions, Member States' authorities, the private sector for the development of commercial downstream applications and services, international partners, the global scientific community, and interested citizens.